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None

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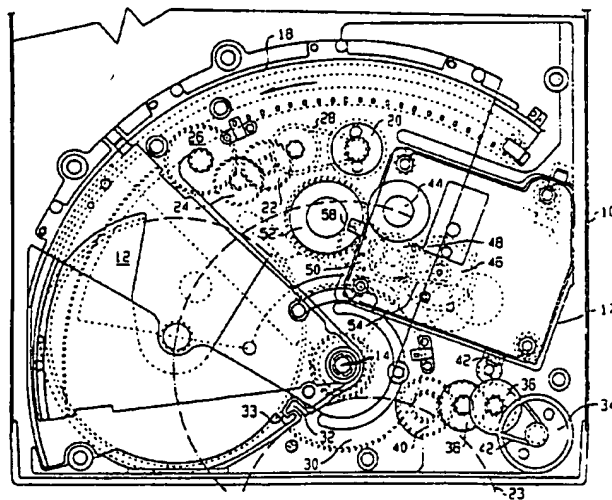
UK CL (Edition N) G5R RB73 RCC RPC2

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(54) Disc shaped media storage and retrieval

(57) A disc handling mechanism 10 that stores a plurality of discs in individual trays 12 mounted one above the other on a shaft (fig 1, 14) and which moves a selected tray 12 from a storage position to either an access position 23 or a read position, and returns the selected tray to the storage position. Each tray may be rotated about a shaft to any one of three relevant points: storage, access and read. In the storage position, the plurality of trays are stored in a vertical stack, with each disc resting horizontally on an individual tray. In the access position, a tray may be selected and rotated about the shaft to expose the tray and provide access to retrieve or insert a disc, even while the handling system is reading another disc retrieved from another storage tray. In the read position, the tray delivers a disc to the laser reader, which retrieves the disc from the tray and reads the disc.

FIG. 2



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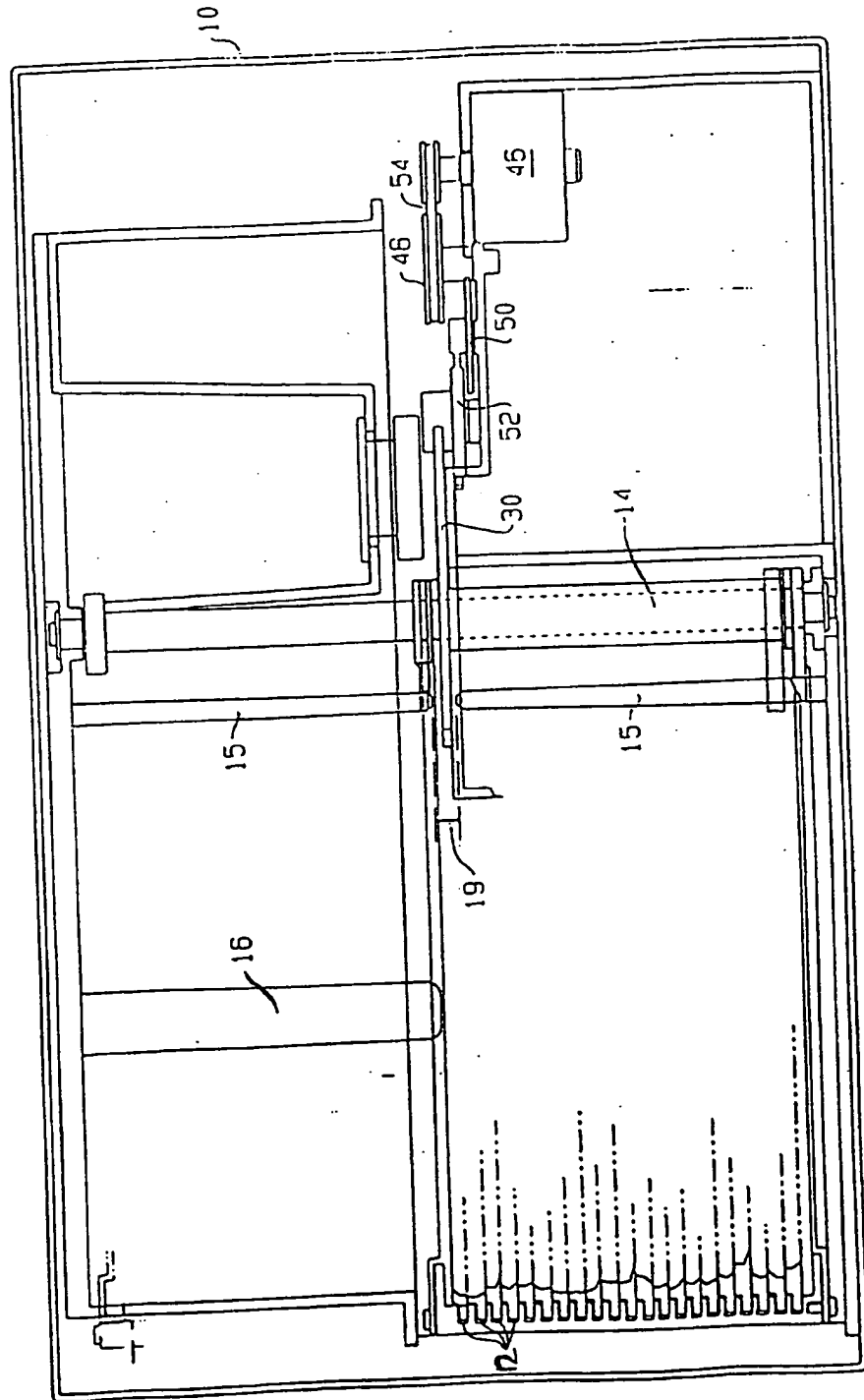


FIG. 1

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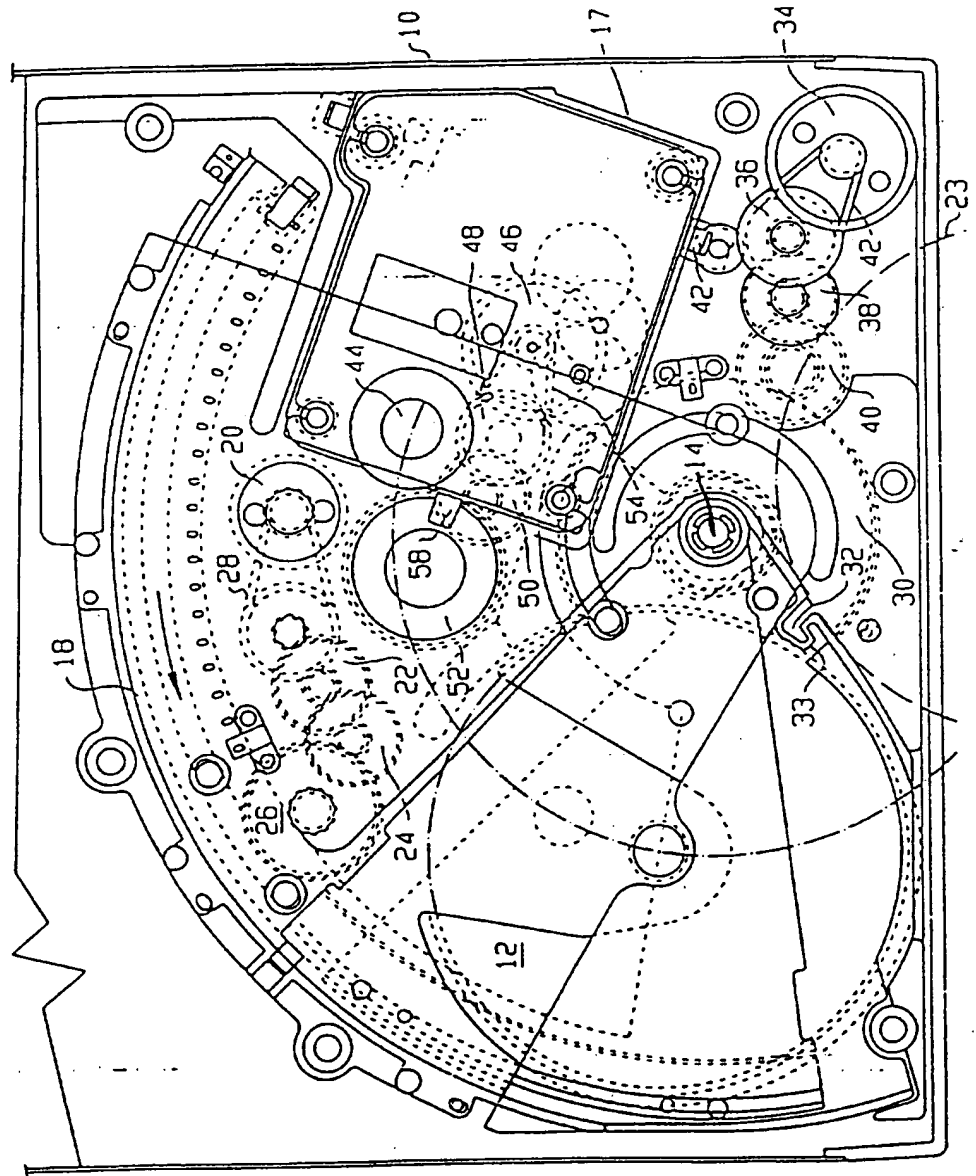


FIG. 2

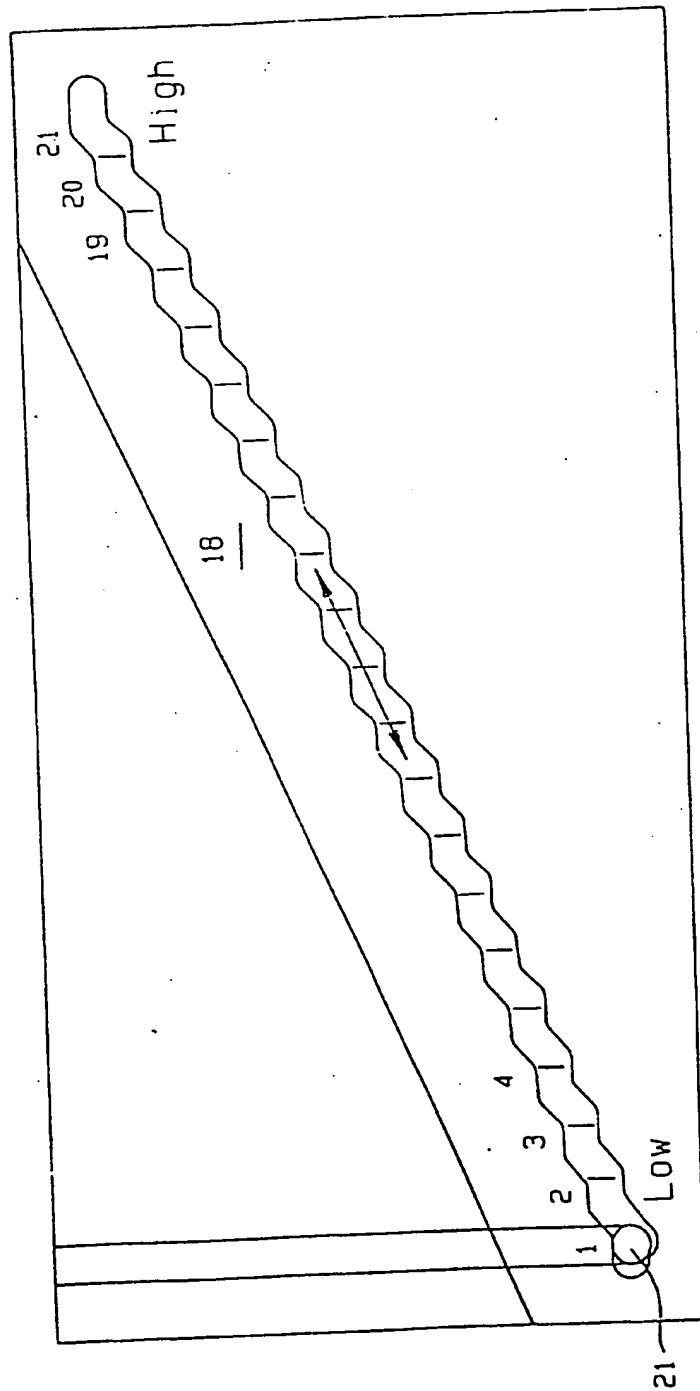
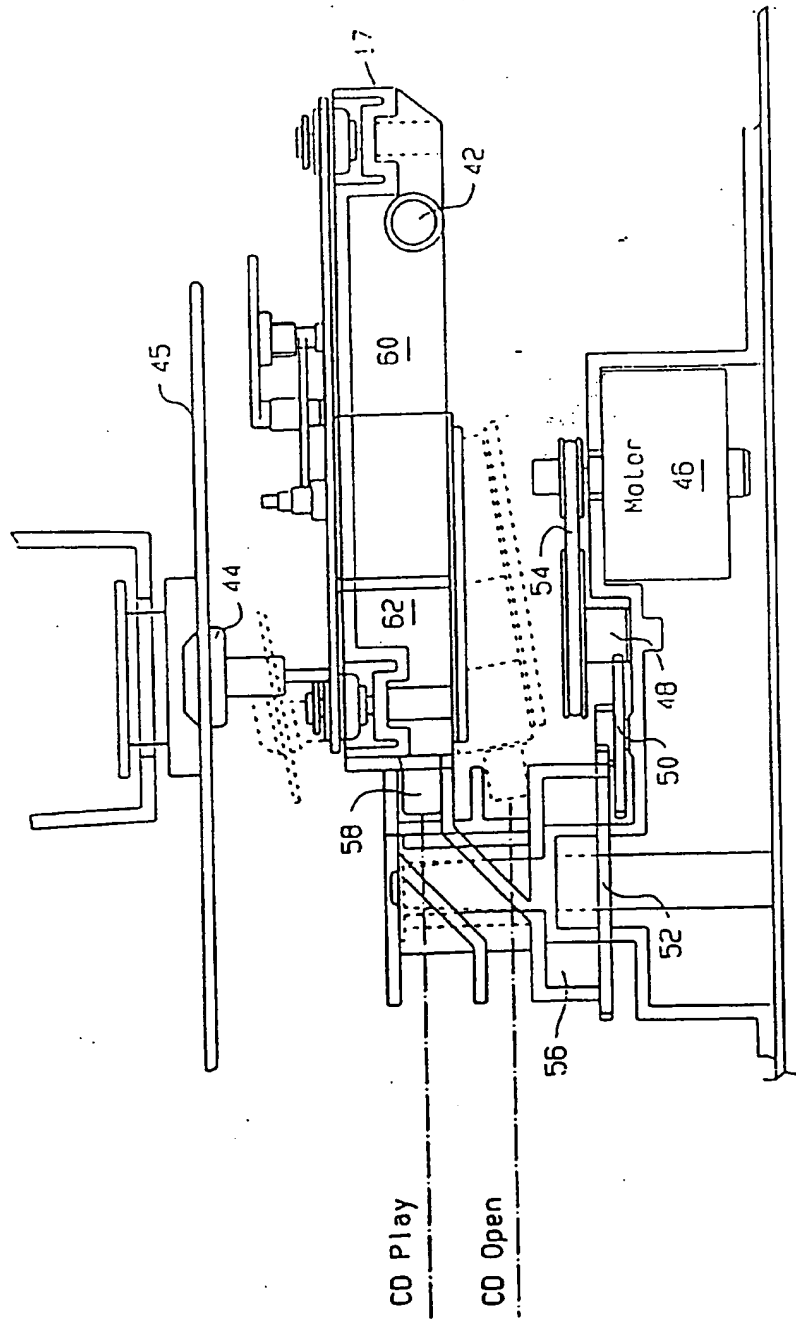


FIG. 3



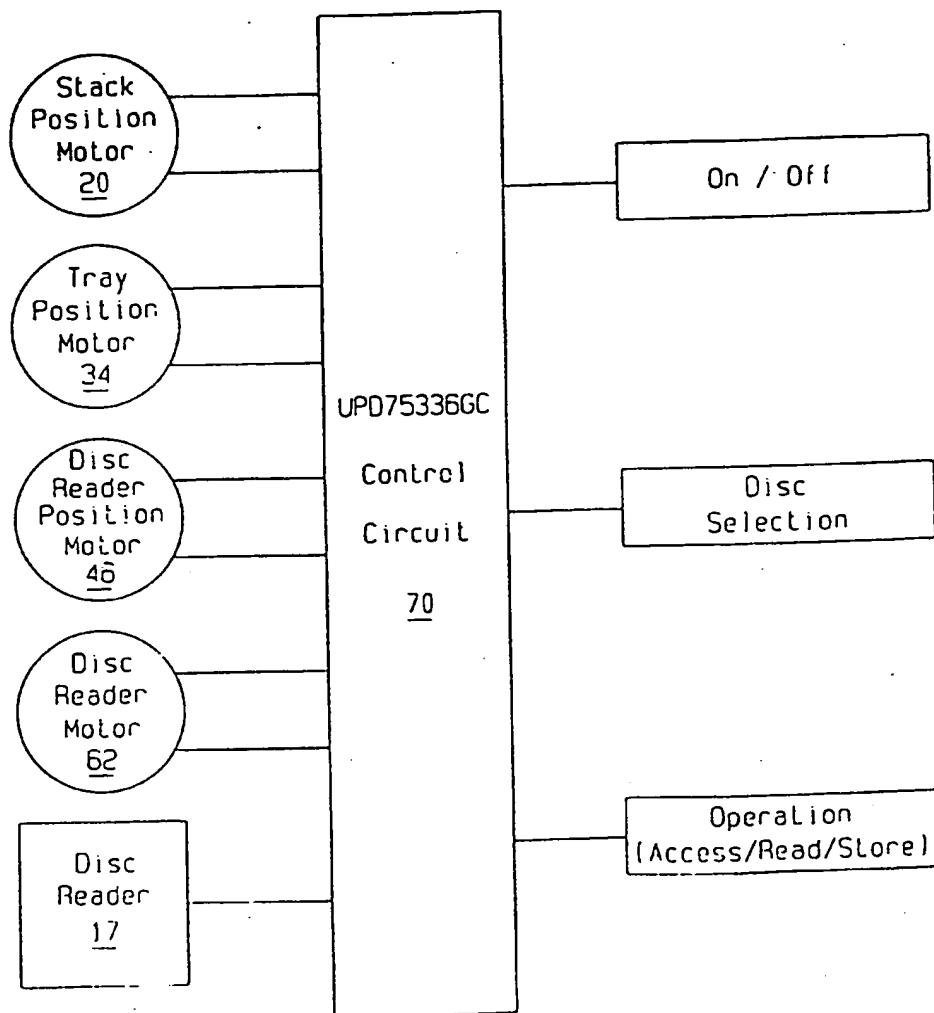


FIG. 5

DISC-SHAPED MEDIA STORAGE AND RETRIEVAL

5 This invention relates generally to a disc-shaped media storage and retrieval apparatus and method, and relates more particularly to an improved mechanism for storing and handling a plurality of discs such as compact discs and for inserting any one of them into a player or reader.

10 One form of data storage is in digital form on an optical data disc. In use at present are optically based disc systems which store speech and music as digitally encoded information on a disc and retrieve the speech and music by reading the information from the disc with a laser and converting it, through one or more audio
15 speakers, to sound. Alternative disc systems store data (including, possibly, speech and music) in digital form for use by computers.

Some disc handling systems will hold and read only one disc at a time. Others can hold a number of discs in
20 a storage unit and allow the user to select any one of the stored discs from the storage unit to be read at a given time. Upon selection, the handling system retrieves the specified disc from the storage unit and places it in a position to be read by the laser. When
25 the disc is no longer needed it is returned to the storage unit and, if directed, the handling system retrieves another disc for use.

One drawback of many present multiple disc handling systems is that the user is unable to insert or remove a disc from the handling system while another disc is being
30 read by the system. Instead, when the user wants to insert or retrieve a disc from the handling system, the user must direct the handling system to return the disc being read to the storage unit, then remove the storage

unit from the sound system, insert or replace the desired disc into the storage unit, and return the storage unit to the sound system.

5 It would be desirable to have a multiple disc handling system that allows the user to insert or remove a disc from among those stored in the handling system without interrupting any disc then being read by the system.

10 According to the present invention there is provided an apparatus for storing and retrieving disc-shaped media comprising:

a pivot;

15 a plurality of trays rotatably mounted along the axis of the pivot, each of said trays being adapted to receive a disc-shaped medium, each of said trays being rotatable between a first position for storage of the disc-shaped medium, a second position for access to the disc-shaped medium by an operating means and a third position for access for insertion or removal of the disc-shaped medium; and

20 means for causing relative movement of the trays and the operating means in a direction generally parallel to the axis of the pivot to allow access to different trays.

25 The pivot may include a shaft on which the trays are rotatably mounted. Alternatively an arrangement may be provided in the form of a stack of independently rotatable collars forming part of the trays to allow them to be moved and rotated.

30 In one embodiment a disc handling mechanism is provided that stores a plurality of discs in individual trays mounted one above the other on a shaft, which shaft acts as the pivot point for each tray. Each tray may be rotated about the shaft to any one of three relevant points: storage, access and read. In the storage

position, the plurality of trays are stored in a vertical stack, with each disc resting horizontally on an individual tray. In the read position, a tray may be selected and rotated about the shaft to deliver a disc to a laser reader, which retrieves the disc from the tray and reads the disc. In the access position, a tray may be selected and rotated about the shaft to expose the tray and provide access to retrieve or insert a disc, even while the laser reader is reading another disc retrieved from another storage tray.

The apparatus of the present invention has the advantage that, even while the disc reader is reading a disc retrieved from a given tray, any other tray may be accessed for insertion or removal of additional discs. Another advantage is that each stored disc is protected from dust and other elements by its own tray. A further advantage is that the number of discs which may be stored and accessed in this manner is limited only by practical concerns such as the desired external dimensions and weight of the disc reader.

According to the invention there is further provided a method of storing and retrieving disc-shaped media in which respective disc-shaped media are received in one of a plurality of trays rotatably mounted on a pivot and are rotated from a first storage position to a second position for access to the tray by an operating means, and are rotated from the first storage position to a third position for access to the tray for insertion or removal of the disc-shaped medium, and wherein either of the trays or the operating means are moved relative to one another in a direction parallel to the longitudinal axis of the pivot to allow access to different trays.

In one form of the invention there is further provided an apparatus for storing and retrieving disc-

shaped media comprising:

a shaft having a longitudinal axis,

5 a plurality of trays mounted on said shaft, each of said trays being adapted to receive a disc-shaped medium, each of said trays having a first angular position wherein the disc-shaped medium is stored, and

10 means for moving the trays along the longitudinal axis of the shaft so as to change the axial position of the disc-shaped media on the shaft, each tray being rotatable at a first axial position on the shaft from the first angular position to a second angular position wherein the tray may be accessed by a means for using the disc-shaped media and each tray being rotatable at at
15 least one axial position on the shaft from the first angular position to a third angular position wherein the tray may be accessed for insertion or removal of the media, whereby disc-shaped media on different trays can be accessed and employed by said using means.

20 In another form of the invention there is yet further provided an apparatus for storing and retrieving disc-shaped media comprising:

a moveable shaft having a longitudinal axis,

25 a plurality of trays mounted on said shaft, each of said trays being adapted to receive a disc-shaped medium, each of said trays being rotatable about said longitudinal axis among a first position wherein the disc-shaped medium is stored, a second position wherein the tray may be accessed for insertion or removal of the medium and a third position wherein the tray may be
30 accessed by a means for using the disc-shaped media, and

means for moving at least one of the shaft and the using means in the direction of the longitudinal axis of the shaft so as to retrieve the disc-shaped medium from a selected tray and to change the position of the

retrieved disc-shaped medium relative to the using means whereby disc-shaped media on different trays at different heights can be accessed and employed by said using means.

5 An embodiment of the invention will now be described by way of example with reference to the drawings, of which:

10 Fig. 1 is a side view of a preferred embodiment of a disc handling mechanism according to the present invention, with all disc trays shown in the stored position, but with certain internal components now shown for clarity;

Fig. 2 is a top view of the disc handling mechanism of Fig. 1;

15 Fig. 3 is a side view of the disc positioning cam of the disc handling mechanism of Fig. 1;

Fig. 4 is a side view of the disc reader of the disc handling mechanism of Fig. 1; and

Fig. 5 is a block diagram of a control circuit which directs the disc handling mechanism of Fig. 1.

20 Fig. 1 depicts a preferred embodiment of a disc handling mechanism 10 of the present invention. The mechanism includes a plurality of storage trays 12 extending horizontally (i.e., perpendicular to the plane of the drawing) and stacked one above the other on a vertical shaft 14.

25 Each disc tray 12 is capable of holding a single disc, which can be CD-ROM, CD-RAM, or other type of media storage disc, depending on the intended application. The stack of disc trays may be moved vertically over the entire length of the shaft 14 by apparatus described below. The mechanism further includes stabilizing posts 15, which are separated by a gap 19, and a stabilizing post 16. Stabilizing posts 15 and 16 help assure that

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only one selected disc tray 12 is free to move in the horizontal direction through gap 19 at any given time.

Horizontal movement of a selected disc tray 12 is caused by a drive assembly comprising a motor 46 that is connected to gears 48, 50 and 52 by a belt 54. Gear 52 turns a disc tray driver 30 which causes the selected disc tray to move among the read, access or storage positions. Associated with the plurality of trays 12 is a disc reader 17 (See Fig. 2), which grasps and reads a selected disc delivered to it by a means for automatically moving a selected disc tray 12 into one of several positions.

As shown in Fig. 2, a selected tray 12 can be rotated about the shaft 14 to access position 23, allowing the user to insert or remove a disc on the tray 12. A selected tray can also be rotated about shaft 14 to deliver a disc to disc reader 17. In either case, the user selects at a control panel (see Fig. 5) the desired operation (access or read) and one of the plurality of disc trays 12 to be acted upon. In response to these selections, a control circuit 70 (see Fig. 5) directs a positioning cam 18 (see Fig. 2) to move, which changes the vertical position of the disc stack so that the selected disc tray 12 is moved to alignment with gap 19 in Fig. 1 so that it may be rotated horizontally either to the access position 23 or to the disc reader 17.

Fig. 3 is a side view of positioning cam 18 showing pin 21. Pin 21 is directly connected to the bottom of the stack of disc trays 12 so that moving pin 21 up or down a given distance causes the entire stack of disc trays 12 to move up or down the same distance on shaft 14. In particular, moving positioning cam 18 in the horizontal direction from right to left as shown on Fig. 3 causes pin 21 to move upward, raising the entire stack

of disc trays 12 in a corresponding stepped fashion. Conversely, moving positioning cam 18 in the horizontal direction from left to right causes pin 21 to move downward, allowing the entire stack of disc trays 12 to descend on shaft 14. When pin 21 is at the bottom of positioning cam 18, the disc tray at the top of the tray stack is aligned with gap 19 in a position to be accessed or read. Similarly, when pin 21 is at the top of positioning cam 18, the disc tray at the bottom of the tray stack is in position to be accessed or read.

Returning to Fig. 2, a motor 20 moves the positioning cam 18 in the horizontal plane via a belt 28 and a set of gears 22, 24 and 26. Gear 26 meshes with gear teeth formed on the inner edge of positioning cam 18 such that when the control circuit directs motor 20 to rotate, positioning cam 18 moves in a horizontal direction, which causes pin 21 to raise or lower the entire stack of disc trays 12 so that a disc tray 12 selected by the user is aligned with gap 19 and tray driver 30. The selected disc tray 12 may then be moved by tray driver 30.

The tray driver 30 is driven by gear assembly 36, 38 and 40, which is connected to motor 34 by belt 42. An integral component of tray driver 30 is a driving hook 32, which rides within a correspondingly-shaped insert 33 cut into each of the disc trays 12 so that as the disc tray stack is raised or lowered, successive inserts 33 engage driving hook 32, one disc tray 12 at a time. When a selected disc tray 12 has been positioned at the level of the tray driver 30, control circuit 70 directs the tray driver 30 to move the selected disc tray 12 to either the access position 23 or to the disc reader 17.

If the user has directed the selected disc tray 12 to be moved to the access position 23, the control

circuit will cause the tray driver 30 to rotate counterclockwise a predetermined distance, causing the selected disc tray 12 to move to the access position 23. The user may select any of the plurality of disc trays 12 to be moved to the access position 23, except that the control circuit will not move a disc tray 12 to the access position 23 when that particular tray 12 has delivered a disc to the disc reader 17 but has not yet retrieved that disc.

5 If the user has directed the selected disc tray 12 to be moved to the disc reader 17, the control circuit will cause the tray driver 30 to rotate clockwise a predetermined distance, causing the selected disc tray 12 to move to the disc reader 17. The control circuit will then cause motor 46 to rotate disc reader 17 so as to engage the disc and it will then activate the disc reader motor. The user may select any of the plurality of disc trays 12 to be moved to the disc reader 17, except that the control circuit will not move a disc tray 12 to the disc reader 17 until it first retrieves from the disc reader 17 any disc then being read.

10 As shown in Fig. 4, disc reader 17 comprises a disc gripper 44, a reading mechanism 60, including a disc drive motor 62, and a pivoting mechanism which rotates the reader about shaft 42. The pivoting action is achieved by a motor 46 which is connected to a gear assembly 48, 50 and 52 by a belt 54. Atop gear 52 rests a screw cam 56, which when turned acts on a positioning tab 58 which is an integral part of disc reader 17.

25 In operation, the disc reader 17 will normally rest in the down position until a disc is delivered to be read. When the unit delivers a disc, the control circuit causes motor 46 to turn, which raises disc reader 17 and causes gripper 44 to engage the centre hole of the

delivered disc and raises the delivered disc above the plane of the selected disc tray 12 (not shown) so that the disc tray 12 is free to return to the stacked position. The control circuit then causes the disc tray 5 12 to return to the stacked position, and causes the disc reader 17 to read the disc. When the disc is to be returned to its disc tray (whether because it has been completely read or on instruction from the user), the control circuit waits for the empty disc tray 12 to move 10 into place underneath the disc in the disc reader 17 and then causes motor 46 to turn, which causes the disc reader 17 to pivot downward, releasing the disc from gripper 44 onto the disc tray. The control circuit then returns the disc tray 12 to its stored position.

15 As shown in Fig. 5, the control circuit 70 directs the operation of the motors 20, 34, 46 and 62 based on instructions from the user. In addition, the control circuit also directs the operation of the disc reader itself.

20 In particular, the control circuit will, in response to a selection made by the user, cause motor 20 to move positioning cam 18 in the horizontal plane, in turn causing the stack of disc trays 12 to move in the vertical plane until a selected disc tray 12 reaches the 25 level of air gap 19 and tray driver 30. When the selected tray has reached the level of tray driver 30 the control circuit directs motor 34 to operate, which causes the tray driver 30 to move the selected disc tray 12 in the desired direction.

30 From the above description, it will be apparent that the invention disclosed herein provides a novel and advantageous apparatus for a disc handling-system for selecting and loading any one of a plurality of media discs onto a disc reader while simultaneously allowing

additional discs to be removed from and inserted into the handling system. The foregoing discussion discloses and describes merely exemplary methods and embodiments of the present invention. As will be understood by those
5 familiar in the art, the invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. For example, different mechanisms may be devised for mounting the trays or for moving the stack of trays vertically or for
10 pivoting the trays to the different positions. And rather than move the stack of trays with respect to the tray driver and disc reader it is possible to devise systems in which these elements are moved with respect to the stack of trays. Accordingly, the disclosure of the
15 present invention is intended to be illustrative, but not limiting, of the scope of the invention, which is set forth in the following claims.

CLAIMS

1. An apparatus for storing and retrieving disc-shaped media comprising:
 - 5 a pivot;
 - a plurality of trays rotatably mounted along the axis of the pivot, each of said trays being adapted to receive a disc-shaped medium, each of said trays being rotatable between a first position for storage of the disc-shaped medium, a second position for access to the disc-shaped medium by an operating means and a third position for access for insertion or removal of the disc-shaped medium; and
 - 10 means for causing relative movement of the trays and the operating means in a direction generally parallel to the axis of the shaft to allow access to different trays.
2. An apparatus as claimed in claim 1 in which the pivot is moveable in the direction of the axis relative to the operating means.
- 20 3. An apparatus as claimed in claim 1 in which the operating means is moveable in a direction generally parallel to the axis of the pivot relative to the pivot.
- 25 4. An apparatus as claimed in claim 1 in which there is further provided means for moving the trays along the axis of the pivot so as to change the axial position of the disc-shaped medium on the pivot.
- 30 5. An apparatus as claimed in any preceding claim for storing and retrieving CD-ROM disc-shaped media.
6. An apparatus as claimed in any of claims 1 to 4 for

storing and retrieving CD-RAM disc-shaped media.

7. An apparatus as claimed in any preceding claim wherein the tray is rotated in a plane perpendicular to the longitudinal axis of the pivot.

8. An apparatus as claimed in any preceding claim wherein the rotation of said trays and the relative movement of the trays of the operating means is directed by a control means which controls movement of the moving means in response to selection of a particular tray and which controls rotation of the trays in response to selection of a particular operation to be performed.

9. An apparatus as claimed in any preceding claim wherein the pivot includes a shaft on which the trays are rotatably mounted.

10. A method of storing and retrieving disc-shaped media in which respective disc-shaped media are received in one of a plurality of trays rotatably mounted on a pivot and are rotated from a first storage position to a second position for access to the tray by an operating means, and are rotated from the first storage position to a third position for access to the tray for insertion or removal of the disc-shaped medium, and wherein either of the trays or the operating means are moved relative to one another in a direction parallel to the longitudinal axis of the pivot to allow access to different trays.

10. An apparatus for storing and retrieving disc-shaped media substantially as herein described and as illustrated by Figs. 1 to 4 of the drawings.

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Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
 GB 9516363.0

Relevant Technical Fields

- (i) UK CI (Ed.N) G5R (RB73, RPC2, RCC)
 (ii) Int CI (Ed.6) G11B 17/08, 17/10, 17/22, 17/26, 17/30

Search Examiner
 P R SLATER

Date of completion of Search
 26 SEPTEMBER 1995

Databases (see below)

- (i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-
 1 to 11

(ii)

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